NOTES ON SOME POINTS IN CONNECTION WITH ERYSIPELAS.

A Thesis presented to the University of Edinburgh for the degree of Doctor of Science (Department of Public Health)

By

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I. The Recognition of the Infectious and Epidemic Character of Erysipelas.

II. The Micro-organism of Erysipelas.

III. The Notification of Erysipelas.

IV. Bibliography.

The following Thesis was composed entirely by myself

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INTRODUCTORY.

A terrible scourge of our predecessors in the Art of Surgery at a not very remote period, but now, to a great extent, robbed of its terrors by the progress of antiseptic methods, Erysipelas yet retains sufficient importance to render interesting and not altogether unprofitable some account of its etiology, pathology and prophylaxis: and it is the object of these notes to set forth as accurately as may be the present state of our knowledge as to the essential nature, origin and modes of transmission of the disease, and to discuss prophylactic methods with special reference to the advisability or otherwise of including the disease among those to which the provision of the Infectious Diseases Notification Act 1889, or the corresponding part of any local Act (such as Sections 55-58 of the Public Health (London) Act 1891) apply.

It is intended to discuss: -

(1) The steps by which our knowledge of the infectious character of erysipelas came to be established.

(2) The nature of the infective agent and its mode of spread, and the pathology of the disease, so far as is germane to the subject.

(3) The question of Notification.

I.

The Recognition of the Infectious and Epidemic Character of Erysipelas.

1. The etymology of the term Erysipelas; its use by Hippocrates, Galen, and others of the Ancients; and their opinions on the disease (being of no practical importance now-a-days) need not detain us: (+) nor need we here discuss the nomenclature of the numerous varieties of the disease invented (or, at least, described) by the earlier writers, but taking as proved the essential identity of "medical" (spontaneous) and "surgical" (traumatic) erysipelas, we may define Erysipelas as an oedematous superficial dermatitis, caused by special bacteria and characterised by (a) general symptoms: - rigors, cephalalgia, fever and gastric disorder: (b) local symptoms: - redness, heat, pain and swelling: the patch is of a bright red, tense, glossy, limited by a well-marked border, and gradually extending: sometimes accompanied by the formation of vesicles; or of pustules; and sometimes passing on to necrosis or gangrene of portions of skin.

A disease of this form has been known and described as erysipelas since the days of Hippocrates, but it is only within the present century that its contagious nature has been determined, and only within the last twenty years that its specific character and essential cause

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(+) They will be found set forth and discussed by Willan (Cutaneous Diseases, Vol. I. "The Erysipelas") Vautrin (Dict. Encycl. des Sci. Med. Paris 1887, ser. i. Vol. 35. sub voce) and Fehleisen (Die Aetiologie des Erysipels: Berlin 1883, N.S.S. Vol. 95).

have been recognised and investigated.

2. Although it is claimed that Lorry (+) first ventured to call the disease contagious, it was in England that the doctrine was first distinctly promulgated. Wells (§) in a very interesting paper, read in 1798, brought forward a series of cases which occurred in his own practice, and those of some of his friends, (++) in which the disease was passed directly from patient to attendant in many instances. He also cites Cullen (§§) as admitting the possibility of the disease being contagious, but reports as his recollection of that great teacher's verbal comments during his lectures in 1780, that he (Cullen) had only once seen it contagious in the Edinburgh Royal Infirmary: and the inference is that Cullen was unconvinced, and unwilling to admit the doctrine, save in so far as propagation by inoculation went. Willan (▣) seems also to have had some suspicions as to its contagious nature: he cites approvingly Wells's observations and adds to them a case of his own, in which a girl had apparently communicated the disease to her mother who nursed her: Willan hesitates to draw any conclusion from one case, and gives it as the general opinion that "medical erysipelas" is not contagious; it is, how-

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(+) Cited by Vautrin: Dict. Encycl. des Science. Med. 1887, ser. 1, t. 35, p. 461.

(§) Trans. of a Society for the Improvement of Medical and Chirurgical Knowledge, 1800, Vol. II, p. 213.

(++) Mr Whitfield (apothecary to S. Thomas's Hospital) Dr Pitcairn and Dr Baillie (of S. George's).

(§§) "First Lines," II, 228. "This disease is not commonly contagious, (New Ed. 1789) but as it may arise from an acrid matter externally applied, so it is possible that the disease may sometimes be communicated from one person to another."

(▣) Cutaneous Diseases, London 1808, Vol. I, p, 515.

ever, he says, inoculable, in that the fluid from the vesicles is capable of producing similar redness and swelling, etc., when rubbed into the skin, herein exactly following Cullen. The doctrine spread rapidly in England, and within the first few years of the century numerous groups of cases were published by competent observers.

Copland, in his Dictionary, (+) enumerates among the causes of Erysipelas "a miasm from persons affected by the disease, when confined in a close atmosphere: and certain constitutions of the air which are recognised only by their effects." Copland considers the fact of Infection to have been "proved" by Wells, and adds references to other instances on record. Of these a very interesting series is given by Stevenson, (§) in which the disease affected the throat as well as the face, and the infection is very well traced out.

Parr, (++) writing in 1808, says "We have four times seen it epidemic, and more than once we have had reason to suspect that it was communicated by infection."

Dickson (§§) distinctly declares it to be, in his opinion, contagious, and advises isolation; quoting a case in which this was practised with the result that no person was affected save the man who attended the patient.

Another very interesting record is that of Gibson, (¤)

(+) Third Edition (1844) Vol. I, p. 826.
(§) Trans. Med. Chir. Soc. of Edin. 1826, II, 128, (read in 1824)
(++) Dictionary of Medicine, 1809, Vol. I. p. 626.
(§§) Medico-Chirurg. Journal, 1810, Vol. I, p. 615.
(¤) Transactions of Medico-Chirurg. Soc. of Edin. 1829, Vol. III, p. 94.

whose attention was drawn to the subject by Stevenson, and who after noting the fact that serious or fatal cases of Erysipelas had long been absent from his practice, describes a fatal case of traumatic erysipelas, resulting in the death of a medical man in Montrose, in February 1822: thereafter it was noted that "instances of the disease became so frequent and were marked by such peculiar circumstances, as to leave no doubt in the mind of all the medical practitioners (in the district) that Erysipelas was now prevailing epidemically in Montrose and the neighbourhood." This state of things continued for about four years (1822-26) and the mortality is stated to have been high, estimated at fifteen per cent of the cases. and out of a population of about 20,000, some 400 persons were attacked. Gibson also called attention to what he considered points of distinction between the ordinary and the epidemic type of erysipelas: namely, that the latter is more severe and fatal, and is more liable to attack younger and healthier subjects(+) than the former. These same points were noted fifty years afterwards by Smart (§) in reference to an epidemic that occurred at the Haslar Hospital in 1873-74; this latter observer further pointed out that the disease was more amenable to treatment in well-lighted and ventilated rooms than in reverse conditions.

It would serve no good purpose to recount or refer to all the subsequent published records of more or less extensive epidemics. One or two later ones may be men-

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(+) He had cases in young servant girls and lads.
(§) Brit. Med. Journ. 1880, I. p. 200.

tioned.

In 1850, Hill (+) communicated to the Medico-Chirurgical Society of Edinburgh a series of cases illustrating the contagious nature of Erysipelas, with special reference to its relationship with puerperal fever.

Goodridge (§) relates his experiences of three attacks in his own person, two of which ~~are~~ were very distinctly infectious in origin.

Greene (++) gives an interesting record of an epidemic that occurred at Ferns (Co. Wexford) in 1887. In all 45 persons were attacked: 9 of the cases were severe, and seven of these fatal: the severe and slight forms were interchangeable: in other words, severe cases were caught from mild ones, and vice versa: the author does not give any opinion as to the cause or origin of the outbreak.

Humphrey (§§) has described a small group of cases which occurred in his wards: - The first of this group was a woman who became infected in a scratch of the hand by washing rags from an erysipelatous case, and developed phlegmon of the arm. The patients in the next bed and in another bed in the same ward, took erysipelas: and when the phlegmon was nearly well, the first patient took erysipelas of the hand also. Previously to the admission of this woman there had been no cases in the hospital.

A similar case to one of the above - that of inocu-

(+) Edin. Med. Journal, 1850, p. 299. (the page is incorrectly given in the Index): this paper is more fully considered below: (Chapter III, p. 27.)
(§) Practitioner, 1883, Vol. 31, p. 471.
(++) Dub. Journ. Med. Sc. Vol. 87, p. 299.
(§§) Lancet, 1888, I. 557.

lation of a cut finger from facial erysipelas giving rise to phlegmonous trouble in the arm, is noted by Woodring (+)

Reed (§) reported recently an epidemic occurring in a military station: the first case was attended throughout, day and night, by the same man, who, when his patient was recovering, himself developed erysipelas: his attendant, similarly, took the disease; and this occurrence being repeated in one or two instances led Reed to believe that the close confinement involved in continuous attendance has an influence in predisposing to an attack: and it was found that by dividing the nursing of each case between four men, working in six-hour shifts, the epidemic was soon checked.

3. Although the idea originated by Wells was, as has been said, rapidly taken up in England, the leaders of medicine in France long remained faithful to the old views: even as late as 1854, we find Valleix (++) denying all idea of infection.

Piorry (§§) appears to have been the first to have recognised that facial erysipelas begins around excoriations and fissures, and to have suggested that it was due to inoculation.

Velpeau(¤) insisted on the non-spontaneity of so-called "spontaneous" erysipelas; believed in the existence of a

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(+) Med. and Surg. Reporter: Philad. 1889, Vol. LX. p. 512.
(§) Boston Med. and Surg. Journ, 1892, Vol. CXXVI, p. 237.
(++) Guide du Med. Pract. 3rd Ed. 1854, Vol. V. p.368.
(§§) Gaz. Med. de Paris, 1833, ser. II, Vol. I, p.281.
(¤) Leçons orales de clin. Chirurg. 1839, Vol. III, p. 235.

predisposition to attacks of it, and that it is due to the absorption of a septic agent.

Trousseau (+) cited a number of examples of contagion; among them cases of medical students, nurses, a laundress, and others brought in different ways into contact with the disease, and similar evidence was brought forward by others. (§)

In Germany as in France the new doctrine was tardily accepted: the writings of the Germans of the last century are pervaded with the fixed idea that erysipelas is a bilious fever, a doctrine as old as Hippocrates. (++)

Henle (§§) does not include it in his paper, published in 1840, "On the Miasmata and Contagia: and on Miasmatic and Contagious Diseases." And as late as 1847, Chelius (¤) had not departed from the ancient teachings.

To Weruber (¤¤) is due the credit of having first in Germany discussed the parasitic origin of erysipelas: and he was soon followed by Volkmann and Hüter, who in 1869 (separately) began to throw light on the nature of the disease and its association with a micro-organism(ø).

At this point we turn to the history of the steps by which the parasitic theory of the nature of erysipelas was placed on a basis of observation and experimental fact.

(+) See Clinique medicale, Vol. I, p. 181. (3rd Ed. 1868)
(§) See Fehleisen. Die Aetiologie der Erys. 1883.
(++) Ib.
(§§) Pathologische Untersuchungen: Berl. 1840.
(¤) Lehrbuch. Louth's trans. 1847, I., p. 106.
(¤¤) Cited by Fehleisen: (loc. cit.).
(ø) For further evidence, especially good for the history of American epidemics, see Stillé, Internat. Encycl. of Surgery: 1882, Vol. I. p. 168.

II.

On the Micro-organism of Erysipelas.

The points to be discussed in relation to the essential cause of erysipelas are: -

(1) The discovery of micro-organisms (one or more) associated with the disease and capable of reproducing it.

(2) The question whether the organism is always one and the same, or whether there is more than one species of microbe which can produce erysipelatoid phenomena; and also whether one and the same microbe can, in varying circumstances, produce erysipelas on the one hand, and other phenomena, such as suppuration, on the other.

1. The first point is not difficult to dispose of:- The earliest reliable researches into the pathological anatomy of erysipelas were those of Vulpian and Nepveu in France, and Volkman and Steudener, and Hüter in Germany.

Vulpian (+) examined skin from a fatal case of erysipelas, and found a number of leucocytes infiltrating the true skin, and especially notes that these leucocytes do not lie in, or around, or follow the course of the blood-vessels.

Volkman and Steudener (§) noted the leucocytes in the lines of the lymph channels: and saw in the evolution of the disease proof of its micro-organismal origin and

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(+) Vulpian, Arch. de Physiologie, 1868, I. 314.
(§) Centralbt. f. d. Med. Wiss. 1868, VI, 561. See also Pitha and Billroth: Handbuch der allgem. w. spec. Chirurg. I. Art. "Erysipelas."

believed in traumatic infection in all cases.

Hüter (+) described septic erysipelas of wounds as a species of diffuse diphtheritis of the skin and saw small "monads" (monas crepusculum - a strepto-coccus) in the tissue-juice and in the blood.

Nepveu (§) also probably saw the micro-organism, which he identified as the bacterium punctatum of Ehrenberg; he examined, in ten cases, blood obtained by pricking the skin of the affected, and also of some unaffected, part (the finger): in every instance the bacteria were found in large numbers in the blood from the affected patches; and in much less considerable quantities, in all cases but one, in blood taken from unaffected parts: the organism was found in both "traumatic" and "spontaneous" cases.

In 1870, König (⊠) produced true erysipelas in rabbits by inoculating fluids from human erysipelas; but only a transitory pseudo-erysipelatous redness with discharges after operations.

In 1873, Orth (++) published an account of an extensive research he had carried out with reference to Erysipelas. He made series of experiments (a) on the transmissibility of Erysipelas generally; (b) on the action of ~~anti-facially~~ artificially cultivated erysipelas-bacteria, (c) on the action of the exudation after the death of the organisms it contains: and his results may be summed up as follows: -

(+) Berlin, Klin. Woch. 1869, p. 359.
(§) Comptes Rendus de la Soc. de Biologie, 1870. ser. 5, Vol. II, p. 164.
(⊠) Arch. der Heilk. 1870, p. 23.
(++) Arch. f. exp. Path. u. Pharm. 1873, Vol. I. p. 81.

(1) Traumatic wound-erysipelas is due to a poison existing in the blood and in the exudation poured into the affected skin.

(2) This exudation is capable of reproducing the disease in man and animals by inoculation.

(3) The micro-organism is in direct relation to the septic cause of erysipelas: the growth of the micro-organism and the spread of the disease go on pari passu.

(4) The symptoms of the diseases can be reproduced by artificial cultures. (+)

Orth seems to have thought that the removal of the organisms from the exudation by filtration weakens but does not destroy the infecting qualities of the fluid. He describes the organism as spherical, immobile and isolated or in chains. (Schizomyces microsphaera of Cohn)

Lukomsky,(§) in a research published in 1874, confirmed by histological and experimental examination of nine cases, the results obtained by previous observers. He found micrococci constantly present in the lymph-channels in cases of recent erysipelas, and made the interesting observation that in some cases, at least, they disappeared during the retrogression of the disease, even while the inflammation was still acute. Experimentally, his results corresponded with those obtained by Orth.

(+) Orth cultivated the organisms on a medium of sugar and ammomium phosphate, and obtained by inoculation into animals redness of the skin, abscesses, oedema and fever.

(§) Virch. Archiv. 1874, Vol. LX, p. 418.

Klebs (+) also recognised a microbe in a case of erysipelatous phlegmon.

Billroth (§) referring to the researches of Orth and Lukomsky, admits that the propagation and multiplication of the erysipelatous contagium resembles very closely the propagation and multiplication of a ferment; considers that it has yet to be proved that the micrococci are the carriers of the ferment, still more that they are the only ones; and whilst admitting the close connection between the growth of the micro-organisms and the extension of the erysipelatous patches, pointed out by Orth (and confirmed by observations made by Ehrlich (¤)) considers that these observations fail to settle conclusively the question of the etiology of the disease.

Tillmanns (++) was also of opinion that the micro-organisms had no immediate relation to the causation of the disease, while admitting the existence of some specific and inoculable poison: as a result of his experiments he could only obtain a positive result from inoculation in five out of twenty five cases; and concludes that the spread of erysipelas by inoculation from man to man is rare. He also failed to find bacteria in some cases; this, however, is explicable in the light of Lukomsky's observations already referred to, and those of subsequent observers.

(+) Arch. f. exp. Path. u. Pharm. 1875, Vol. IV. p. 451.
(§) Lectures on Surgical Pathol. (N.S.S. trans.) 1878. Vol. II, p. 14.
(¤) Langenbecks Arch. 1876, Vol. XX, p. 414.
(++) Arch. f. klin. Chirurg. 1879, Vol. XXIII, p, 437.

Bellien (+) supported Tillmanns in his views as to the non-specific character of the disease by the injection of any septic fluids, and that the bacteria are irrelevant to the genesis of erysipelas.

Wolff (§) found micro-organisms in the blood, diseased skin, contents of vesicles, abscesses, and internal organs: he, however, is by no means certain that these organisms are the cause of the disease, considering that the origin is doubtful, but that the organism, in some way acts as a poison-carrier.

Ziegler (¤) in 1881 satisfied himself that erysipelas is due to a micro-coccus, spreading by way of the lymphatics: his animals (rabbits) suffered from tissue-necrosis and usually died.

Koch (++) examined eight cases: three fatal and five during life; and photographed the micro-organism, which was studied by Fehleisen, (§§) whose results were entirely and independently corroborated.

2. This research (now fairly to be called classical) included histological and experimental investigation upon thirteen cases, of which two were fatal.

Of the histological part of the investigation, directed to simple, uncomplicated cases at successive stages, the results were as follows: -

The erysipelatous patch consists of three zones:

(+) Centralb. f. Chirurg. 1876, p. 325.
(§) Virch. Archiv. 1879, Vol. LXXXI, pp. 233 and 396.
(¤) Text-book of Path. Anat. par. 204 and 375 (Macalister's translation)
(++) Mitth. a. d. k. Gesundheitamt. 1881, Vol. I, p. 39.
(§§) Deutsch. Zeitschr. f. Chir. 1882, Vol. XVI, p.391. Die Aetiologie der Erysipels, 1883, N.S.S. or XCV. p. 261,

(1) The outer zone, apparently healthy to the naked eye, exhibits, under a high power, micrococci in course of rapid growth ~~are found~~ in the lymph spaces.

(2) The middle zone: the red margin of the patch: shows marked inflammatory phenomena, with infiltration of leucocytes: the micrococci are among and within the leucocytes.

(3) In the inner zone there is more inflammation and fewer micro-organisms.

The micro-coccus(streptococcus erysipelatosus) is 0.3 μ in diameter; joined in pairs or chains, often of sinuous form: they occur in groups in interfascicular spaces, in lymph vessels and in subcutaneous fat, in the latter instance in the perinuclear protoplasm. They do not occur in the blood vessels. They are found in greatest abundance at the spreading margin of the erysipelatous patch.

In attempting to obtain pure cultivations, Fehleisen failed with the fluid from the erysipelatous vesicles, there being either no micro-organisms at all, or a too great variety to be easily distinguished and separated. The method employed consisted in placing small pieces of skin from the spreading margin upon gelatine, liquid at 40°C., this being found a more suitable medium than solidified serum. The organism thus separated was cultivated through several generations, and from these, inoculation experiments were made upon animals and upon the human subject: the latter course (which gives the last step and, in many cases that most difficult to ob-

tain, in the proof of the specific character of a given organism) being justified by the fact that under the action of artificially induced erysipelas (erysipèle salutaire) beneficial results have been obtained in the treatment of lupus and some forms of malignant tumours.

Fehleisen inoculated the ears of nine rabbits with various generations of his cultures, and in eight instances succeeded in producing an attack of erysipelas, which was mild, in no case fatal, and unattended with any necrosis.

The experiments on the human subject were seven in number, all of whom had undoubted erysipelas;(+) with the therapeutic results we are not here concerned: but it is interesting to note that, in two of the cases, ~~that~~ inoculation after recovery from the first attack produced no result.

Thus Fehleisen was enabled to fulfil in his research in a very perfect manner, the Canons laid down by Koch for the demonstration of the micro-organismal nature of any given disease, including, as he was able to do, inoculation of the human subject.

3. Following the publication of Fehleisen's paper, there arose a discussion as to the identity of the Streptococcus erysipelatosus ~~with~~ with one of those associated with suppuration - the streptococcus pyogenes: and much research has been devoted to the matter, of which the

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(+) Janicke and Neisser (Centralbl. f. Chirurg. 1884, p. 461) recorded a fatal case of mammary carcinoma treated by inoculation with erysipelas, in which the micrococci were found in the carcinomatous tissues (shewn in drawings)

following account is an abstract.

The following description of the two organisms is given by Dr Woodhead. (+)

"The Colonies are white, small, not confluent, and growing slowly, and not liquefying gelatine.

(1) Streptococcus pyogenes: On plates grow as small punctiform masses ½ m.m., at first appear white, pale yellow and then brown, under low power of the microscope: no tendency to run together in either plate, puncture or stroke cultivations, except on blood serum, or agar-agar, where the mass is thicker in the centre. .....Cocci 1 μ in diameter arranged in chains or diplococci, not pathogenic to mice or healthy rabbits: frequently found in pus in human subject and in lymphatics near spreading margin of suppurating area.

(2) Streptococcus erysipelatosus: Very like the above, but differs in that in stroke cultivations the colonies have a somewhat greater tendency to run together: these appear whiter and more opaque, and have at the periphery numerous outgrowths which consist of projecting chains which give to the cultivation the appearance of a fern leaf: found in the lymphatics of the spreading zone of an erysipelatous area: it sets up erysipelatous inflammation when inoculated into the ear of a rabbit; sets up typical erysipelas and not suppuration in man."

From this systematic description it will be evident that the morphological differences between the two organisms are very minute.

(+) Bacteria and their products. Appendix, p. 44, London 1891

Rosenbach, (+) whose description is mainly that given above, believes that the organisms are different; and suggests that the strepto-coccus erysipelatosus, though incapable of liquefying gelatine in the presence of air, is capable of dissolving serum in the absence of air.

Passet (§) failed to distinguish the streptococcus erysipelatosus from the streptococcus pyogenes, and from the streptococcus of puerperal fever in cultivations on gelatine or agar-agar; among other points he found that both streptococcus erysipelatosus and streptococcus pyogenes produce an apparently identical keratitis when inoculated into the cornea of dogs.

Simone (¤) recorded a case of excision of the shoulder joint which became pyaemic after being attacked with erysipelas, other similar cases having come under the author's notice. In cultivations from the case a streptococcus, indistinguishable from that of Fehleisen and Passet, was found in the blood, pus and various organs.

Ferraro (++) carried out a research which in the main confirmed that of Fehleisen.

Hajek (§§), while considering that the morphological differences described by Rosenbach are trifling and due to external causes, nevertheless, as the result of a very long series of experiments, concludes that the two

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(+) Mikro-organismen bei den Wundinfectionskrankheiten der Menschen, 1884, p. 24.
(§) Forschritte der Med. 1885, p. 38.
(¤) Il Morgagni, 1885, Vol. XXVII, p. 457.
(++) Il Morgagni, 1886, Vol. XXVIII, p. 335.
(§§) Deutsch. Med. Woch. 1886, No. 47. rep. (with discussion) La Semaine Med: 1886, p. 460: also Lond. Med. Rec. 1887, p. 164.

organisms are different. He made inoculations with (a) a cultivation in the 30th generation from a case of classical erysipelas of the hand: (b) the 15th generation from a similar affection of the face: and (c) the 15th generation of a culture from pus of an abscess: and in the large majority of numerous injections and inoculations (on rabbits) obtained constant results. Hajek also described certain differences in the distribution of the organisms in the affected areas: maintaining that, while streptococcus erysipelatosus is confined to tne lymph channels and is always associated with exudation cells, the streptococcus of phlegmon wanders into the connective tissue, blocks lymph vessels, forms colonies round the blood vessels (star-like on transverse section), perforates the walls of the vessels and gains access to the blood stream, where the streptococcus erysipelatosus is never found.

Eiselberg, (+) discussing these results, differs from the conclusions stated, and thinks with Passet, that the two organisms are identical, or, at most, two varieties of the same species.

Hoffa (§) endeavoured to point out similar minute differences to those maintained by Rosenbach.

Biondi, (¤) on the other hand, cannot admit any differentiation.

Meßrovitch (++) has very fully investigated the

(+) La Semaine Med. 1886, p. 460: L.M.Rec, 1887,p.5
(§) Forsch. der Med. 1886, p. 77
(¤) La Riforma med. 1886, No. 3. rep. Deutsch. Med. Woch. 1886, p. 132.
(++) Inaug. Dissert. S. Petersburg, 1887. Report in detail in Lond. Med. Rec. 1888, p. 471.

whole question of the histology and bacteriology and erysipelas. He finds that the streptococci occur -

(1) In the "outer" and "middle" zones (of Fehleisen) almost pure: in the inner zone, mixed with other micro-organisms.

(2) In the fluid in recent vesicles: and in the tissue juices: but in older vesicles they are "crowded out" by other species.

(3) In the blood: but only in rare, bad and fatal cases, and then only in scanty numbers.

(4) In abscesses, and sometimes in effusions.

(5) In the viscera in fatal cases.

In experiments on animals, Meĕrovitch found that, of four rabbits he inoculated with streptococcus pyogenes (from the sputum of purulent bronchitis), an erysipelatoid condition supervened in three, and a typical erysipelas in the fourth: and the three above-named proved insusceptible to streptococcus erysipelatosus.

From these and many other observations, he concludes (a) that both streptocuccus pyogenes and streptococcus erysipelatosus when inoculated into the skin produce erysipelas; when placed in the subcutaneous tissue produce pus: (b) that both are in all respects identical: (c) that erysipelas, certain progressive phlegmons and pyaemias are caused by one and the same microbe.

The results thus stated have been independently confirmed. Thus Noorden (+) examined a case, severe and fatal, accompanied by severe general infection and metastatic inflammations. Streptococci were cultivated

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(+) Munch. Med. Woch. 1887, Vol. XXXIV.

from blood, pus, etc., and with a cultivation of one of them (from heart-blood) an erysipelatoid condition was produced in four out of five rabbits inoculated; in these animals, chains of cocci were found in the lymphatics of the affected parts, but none in the blood. In another experiment the animal died, and the blood and lymph vessels and all the organs contained what appeared to be the same streptococcus. This author thinks that Streptococcus erysipelatosus has a variable virulence depending upon circumstances at present unknown, but that it is especially liable to produce general infection in weak individuals. (+)

Doyen (§) found the streptococci occurring in erysipelas, phlegmon, and puerperal fever to be identical histologically, in cultivations, and experimentally, but apparently differing in virulence. And Widal (¤) says that there are no distinctive characters between puerperal fever and erysipelas; that in the present state of science it is impossible to distinguish between the two microbes; and that streptococcus pyogenes produces different forms of puerperal infection; but how these differences arise is not known.

E.Fraenkel (++) (Hamburg) very positively asserts the identity of the two organisms; he produced suppuration with streptococcus erysipelatosus alone.

(+) It may be noted that Meĕrovitch (loc cit.) obtained gastro-intestinal erysipelas in rabbits by feeding them with cultures of streptococcus erysipelatosus, but only when catarrh had been previously induced.

(§) Bullet. de l'Acad. de Med. 1888, Vol. XIX, p. 725.

(¤) Ib. p. 729.

(++) Centralbl. f. Bakt. 1889, Vol. VI, p. 691.

Jordan (+) met with a case in which there developed successively facial erysipelas, suppurative periostitis of the tibia, pneumonia, and again facial erysipelas, and in connection with each manifestation staphylococcus pyogenes was discovered. Going even further than most observers, he believes that erysipelas is non-specific; being, as a rule, due to streptococcus pyogenes, but sometimes to staphylococcus pyogenes: he also considers that the microbe is in every case transmitted in the blood and every opportunity is thus offered for the occurrence of metastatic phenomena: and pyaemia occurring in the course of erysipelas is probably due to the erysipelas-coccus itself. This observer further is of opinion that the differences in action of the pyogenic organism depend upon the particular locality affected and upon variations in virulence, from whatever cause.

A case is also cited by Kirchner (§) of somewhat similar import: in this attack of angina tonsillaris was followed within three days by facial erysipelas: in the secretion in the former, and in the vesicles of the latter, streptococcus pyogenes occurred. These cases do not afford any absolute proof one way or the other, but afford a certain amount of presumptive evidence on the identity of the causation of the diseases in question.

The systematic writers on bacteriology seem agreed that the two organisms are identical: and on a general review of the evidence, that is the conclusion to which it points.

(+) Verhandl. d. Deutsch Geselleschft. f. Chirurg. 1891, Vol. XX, pt. II, p. 66.

(§) Centralbl. f. Bakter. 1892, XI, p.

ADDENDA

The following papers are of interest in reference to various relations of the micro-organisms.

(1) Verneuil and Clado (+), in an experimental research, endeavoured to show that erysipelas and lymphangitis are two forms of one disease; the streptococcus found being identical in both.

(2) In recurrent erysipelas, the microbe is believed to become quiescent, the colonies lighting up into activity under unknown conditions. (§)

(3) Rheiner (¤) believed that Eberth's bacillus of enteric fever produced an affection analogous to erysipelas in two cases (fatal gangrenous erysipelas) and Vincent (++) has recently published a very interesting research on mixed infection with Eberth's bacillus and streptococci.

(4) The relation of streptococcus erysipelatosus to Phagocytosis has been observed by Metschnikoff (§§), Bokenham (¤¤) and Vincent (loc.cit).

(+) Comptes Rendus, 1889, Vol. CVIII, p. 714.
(§) Leroy: La Semaine Med. 1890, p. 69. Hertz and Widal, Bull. de la Soc. Med. d. Hôp. 1891, Ser, 3, Vol. VIII, p. 683.
(¤) Virch. Arch. Vol. C. p. 185.
(++) Annales de l'Inst. Pasteur, 1893, Vol. VII, p. 141.
(§§) Virch. Arch. 1887, Vol. CVII, p. 209.
(¤¤) Brit, Med. Journ. 1892, II, 576.

III.

The Notification of Erysipelas.

1. Erysipelas is one of the diseases to which the provisions of the Infectious Diseases Notification Act (1889) apply. (+) But the advisability of including the disease within these provisions has been doubted on the ground that trivial cases are reported and cases not erysipelas are included, that the results of notification are disproportionate to the expense incurred, and that practically very little attempt is made to isolate at any rate the minor cases.

Thresh (§) has pointed out that accurate information is very difficult to obtain, as Medical officers of Health pay no attention to this disease or to puerperal fever in the ~~text~~ text of their reports: and he gives tables, shewing, from the statistics of a few English Counties over a short time, an enormous range of case-rate and death-rate, not to be attributed to the well-known variability of different epidemics: and even supposing that in some instances there has been a wholesale series of errors in diagnosis, this would not account for the range of death-rate. According to the tables given, the case-rate during 1890 ranged from 36 per 100,000 of population in the West Riding of Yorkshire to 67 in Essex: while for the same period the death-rate ranged from 3⅓ (in 100,000) in Worcestershire to 6 in

(+) And the corresponding Sections of the Public Health (London) Act, 1891.

(§) Brit. Med. Journal, 1892, II, p. 351.

Yorkshire (West Riding): the case-mortality was 15.8 per cent in the West Riding in 1890, but only 5.1 in Essex in 1891.

Dr Thresh points out that notification should materially enhance our knowledge of the disease and its relationships, especially to the group of diseases included under the term "puerperal fever."

2. A year or two ago the Chelsea Vestry approached the Local Government Board with a view to restricting notification to Idiopathic Erysipelas: in a letter, dated 15th August, 1891, the Board state that they see no sufficient reason for a notification of the provisions of the Act (+) as regards Erysipelas, stating (§) that erysipelas is an infectious disease, communicable to others, and of especial danger to lying-in women, vaccinated children, in surgical operations and to wounds generally.

These reasons may be conveniently discussed seriatim as embodying the principal arguments for the present provisions of the law.

(a) That Erysipelas is an infectious disease, communicable to others, has already been amply discussed: some remarks as to the modes in which the contagion is carried and as to its vitality, may be added here: -

There can be no doubt whatever, and it has long been common experience that the disease is transmissible by direct contact: the danger of this, however, is not so

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(+) The Notification of Diseases Act (1889)

(§) So far as I can ascertain; I have been unable to obtain the copy of this correspondence, and have depended for its contents upon the courtesy of Dr Louis Parkes (M.O.H. for Chelsea) and Dr J. Sykes (see also his "Public Health Problems" 1892, p. 193).

great as might be anticipated: Fehleisen (+) found that there was no infective secretion except where vesicles had formed; that even then the secretion was not very virulent; and that experimental inoculation often fails (as earlier writers had noted) when pure cultures were not used.

To account for the "sporadic" or "idiopathic" cases, it has been shown (Fehleisen) that the microbe grows on potatoes at the ordinary temperature of the air, and (Ferraro) (§) that it retains its vitality for a long time dried on silk threads: that is that it can live and increase under conditions that obtain in the world outside the laboratory.

Eiselberg, (ø) differing from Fehleisen, believed that the dried scales thrown off during desquamation were the carriers of infection (as in scarlet fever): he was able to obtain cultures from these scales in four cases out of five. The same observer found the streptococcus erysipelatosus in the air of surgical wards in which cases of the disease had occurred, by exposing sterilised plates to the air: in an isolation ward containing a single case, the only plate upon which any of the specific organisms were found was one placed near the head of the patient.

Emmerich (++) similarly found the organism in the air of a room in which M. Bollinger and an assistant had for some time been working when they fell ill with an

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(+) loc, cit.
(§) loc. cit.
(ø) Langenbeck's Arch. 1887, XXXV. p. 1.
(++) See La Semaine Med. 1886, p. 462.

erysipelatous fever: the origin of the infection could not be traced, nor could the microbe be detected in the walls or their coverings - those favourite resting places for germs of all kinds.

Guyot (+) has lately, as a result of seven years' experience of erysipelas-isolation wards, given his opinion that the disease is contagious in the same sense as the exanthemata generally: he has seen cases of erythema, eczema, and all sorts of eruptions brought by mistake into the special wards, and depart without taking the disease: which also, in his experience, has not been carried by the nurses to other cases nor communicated to the nurses themselves.

It would seem that as a general rule the contagious power of erysipelas is not great, so far as reproducing cutaneous erysipelas is concerned: but there can be no reasonable doubt that it is due to occasional (periodic, seasonal) aggravations, reaching, as has been shown already, epidemic dimensions. Of the conditions and circumstances determining these exacerbations, nothing is at present known. (§)

(b) The next point,- that erysipelas is of special danger to lying-in women,- is of very great importance and raises questions of great magnitude, beyond the scope of these notes. For our present purpose, it is sufficient to attempt to show that some forms, at least, of

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(+) Bull. de la Soc. Med. d. Hopit. ser, 3, Vol. IX, p. 393, 1892.

(§) A suggestion made by Day (Med. Times and Gazette 1871, I. p. 287) as to the influence of moisture does not seem to have any value.

"puerperal fever" are to be traced to infection with erysipelas, and that both are due (in these cases) to a common cause - to a common streptococcus.

From the clinical side (+) it is stated that two centuries ago Peu (§) attributed an epidemic of puerperal fever at the Hôtel Dieu to an epidemic of erysipelas.

This observation seems to have been forgotten until the middle of the present century, until Masson (¤) in France and Hill (++) in Scotland again drew attention to the facts.

Masson pointed out the parallelism which was found to exist between the epidemics of the two diseases in hospitals. Too much stress, however, cannot be laid upon these tables - what is required is that the number of cases of the two diseases should be plotted out for an entire district (not a hospital) for a series of years: a result to which accurate and generalised notification must materially contribute and which is not yet possible.

Hill's observations are of extreme interest: two of his series of cases may be summarised.

Traumatic erysipelas in a man was communicated by him to his wife. Their daughter shortly afterwards came home from a distance, being about seven months pregnant:

(+) See, for fuller account, Raynaud's article "Erysipèle," Dict.de la Med. et Chirurg. pract. Paris, 1871, Vol. XIV, p. 33.

(§) Pratique des Accouchements, 1694, (cited by Raynaud)

(¤) Thèse de Paris, 1849: analysed by Raynaud. (loc. cit,)

(++) Edin. Month. Journ. 1850, p. 299.

she was confined at the seventh month, the child exhibiting erysipelas neonatorum, and its mother dying of malignant puerperal fever. Hill believes that he, attending these cases, communicated the disease to another woman delivered by him, who recovered from a mild attack of puerperal fever.

In a second group of cases, a girl got a mild attack of puerperal fever, during which she was much in company with an old man, who took erysipelas of the fauces, from which he rapidly died.

In these and other groups of cases cited by Hill, not only the interchangeability of the two diseases, but also the variability of the virulence is well illustrated.

Another interesting observation referred to by Raynaud, is one reported by Pihan-Dufeillay (+). Puerperal fever broke out in an obstetric ward, many cases occurring: the patients were all removed, and the ward given up to cases of skin-disease: very soon erysipelas broke out, - not being introduced from without, and in some fatal cases the post-mortem appearances were similar to those met with in other infectious diseases.

Raynaud insists on the close similarity between the two diseases in their etiology, symptomatology, clinical course and anatomical lesions.

Bacteriologically, as has been previously implied, it does not seem possible in the present state of knowledge to distinguish between the streptococcus of erysipelas and that of puerperal fever. (§)

(+) Union Med. 1861, p. 371.

(§) See Hartmann, (1887, Arch. f. Hygiene, VII, p. 83 - 227) Doyen (loc cit supra), Widal (loc cit supra) and Behring (1887, Zeitschr. f. Hygiene VII, p. 183)

It has been said that if erysipelas, puerperal fever and phlegmon and pyaemia be all due to one and the same streptococcus, and are all contagious, why should we be content with notifying some of the forms of the disease and not others?

Such an argument overlooks the essential object of notification - a means to an end - namely, to enable the Authority to cope with a dangerous infectious disease in such a timely manner as to prevent danger to the community, and it has not yet been shown that phlegmon and pyaemic conditions generally are fraught with any such direct and preventible dangers as undoubtedly attend upon the other two forms of disease now under discussion.

The argument that because measles and whooping-cough, which are far more frequent and fatal than erysipelas, are not notifiable (as a rule in this country) therefore we should exclude the latter, refutes itself.

So does the argument that some cases of trivial erythema are reported; for mistakes in diagnosis occur in connection with other notifiable diseases; and excess of precaution is better than the opposite.

(c) The danger to <u>vaccinated children</u> is, perhaps, not very great, but undoubtedly occurs.

<u>Dapp</u> (+) gives an instance in which nine infants vaccinated from a child affected with erysipelas all suffered from the disease.

<u>Airy</u> (§) investigated three cases in which death from erysipelas occurred after vaccination; illustrating the

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(+) Schmidt's Jahrbuch, 1841, Vol. XXX, p. 184.
(§) Report to L.G.Bd. on Post-Vaccinal Erysipelas, 1887.

fact that vaccination wounds may, like any other kind of wound, become points of entrance for the erysipelas poison. In these cases the vaccination is not to blame per se: for in one of Airy's cases the source of infection was traced to a case of facial erysipelas, while the other two children lived in insanitary surroundings. (+)

Seeing that vaccination is fraught with so many imaginary risks in the midst of a certain class of persons, it is essential that every means should be taken to reduce the real risks to a minimum; and for this reason, the notification of erysipelas is not unimportant.

(d) The danger "in surgical operations and to wounds generally" is too well recognised to need further discussion here.

(+) It may be mentioned in passing that the notification of erysipelas may in some cases serve to draw attention to insanitary conditions.

CONCLUSIONS

1. Erysipelas is a contagious and infectious disease.

2. It is caused by the presence of a micro-organism: the streptococcus erysipelatosus.

3. The streptococcus erysipelatosus is indistinguishable according to our present methods from the streptococcus associated with phlegmon and some forms at least of "puerperal fever."

4. Because of its relations to puerperal infection, to vaccination and to surgery, and in order to increase our knowledge of the disease, it is advisable that erysipelas should continue to be a notifiable disease.

IV.

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